

1
32
SEQUENCE LISTING

<110> SCHEMBRI, MARK ANDREW
KLEMM, PER

<120> NOVEL MULTIFUNCTIONAL ADHESIVE PROTEINS AND THEIR
DISPLAY IN MICROBIAL CELLS

<130> 54259.000003

<140> 09/301,704

<141> 1999-04-29

<160> 63

<170> PatentIn Ver. 2.1

<210> 1

<211> 300

<212> PRT

<213> Escherichia coli

<400> 1

Met Lys Arg Val Ile Thr Leu Phe Ala Val Leu Leu Met Gly Trp Ser
1 5 10 15

Val Asn Ala Trp Ser Phe Ala Cys Lys Thr Ala Asn Gly Thr Ala Ile
20 25 30

Pro Ile Gly Gly Gly Ser Ala Asn Val Tyr Val Asn Leu Ala Pro Val
35 40 45

Val Asn Val Gly Gln Asn Leu Val Val Asp Leu Ser Thr Gln Ile Phe
50 55 60

Cys His Asn Asp Tyr Pro Glu Thr Ile Thr Asp Tyr Val Thr Leu Gln
65 70 75 80

Arg Gly Ser Ala Tyr Gly Gly Val Leu Ser Asn Phe Ser Gly Thr Val
85 90 95

Lys Tyr Ser Gly Ser Ser Tyr Pro Phe Pro Thr Thr Ser Glu Thr Pro
100 105 110

Arg Val Val Tyr Asn Ser Arg Thr Asp Lys Pro Trp Pro Val Ala Leu
115 120 125

Tyr Leu Thr Pro Val Ser Ser Ala Gly Gly Val Ala Ile Lys Ala Gly
130 135 140

Ser Leu Ile Ala Val Leu Ile Leu Arg Gln Thr Asn Asn Tyr Asn Ser
145 150 155 160

Asp Asp Phe Gln Phe Val Trp Asn Ile Tyr Ala Asn Asn Asp Val Val
165 170 175

Val Pro Thr Gly Gly Cys Asp Val Ser Ala Arg Asp Val Thr Val Thr
180 185 190



cl
contd

33

Leu Pro Asp Tyr Pro Gly Ser Val Pro Ile Pro Leu Thr Val Tyr Cys
195 200 205

Ala Lys Ser Gln Asn Leu Gly Tyr Tyr Leu Ser Gly Thr His Ala Asp
210 215 220

Ala Gly Asn Ser Ile Phe Thr Asn Thr Ala Ser Phe Ser Pro Ala Gln
225 230 235 240

Gly Val Gly Val Gln Leu Thr Arg Asn Gly Thr Ile Ile Pro Ala Asn
245 250 255

Asn Thr Val Ser Leu Gly Ala Val Gly Thr Ser Ala Val Ser Leu Gly
260 265 270

Leu Thr Ala Asn Tyr Ala Arg Thr Gly Gly Gln Val Thr Ala Gly Asn
275 280 285

Val Gln Ser Ile Ile Gly Val Thr Phe Val Tyr Gln
290 295 300

<210> 2
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Binding motif

<220>
<221> MOD_RES
<222> (2)..(4)
<223> "Xaa" represents a variable, modified or unknown
amino acid

<400> 2
His Xaa Xaa Xaa His Arg Ser
1 5

<210> 3
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Binding motif

<220>
<221> MOD_RES
<222> (2)..(4)
<223> "Xaa" represents a variable, modified or unknown
amino acid

C1
Contd

34

<400> 3
Arg Xaa Xaa Xaa His Arg Ser
1 5

<210> 4
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Binding motif

<220>
<221> MOD_RES
<222> (3)..(4)
<223> "Xaa" represents a variable, modified or unknown
amino acid

<400> 4
Ser Lys Xaa Xaa His Arg Ser
1 5

<210> 5
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Binding motif

<220>
<221> MOD_RES
<222> (3)..(4)
<223> "Xaa" represents a variable, modified or unknown
amino acid

<400> 5
Ser Arg Xaa Xaa His Arg Ser
1 5

<210> 6
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Binding motif

<220>
<221> MOD_RES
<222> (3)..(4)
<223> "Xaa" represents a variable, modified or unknown
amino acid

C)
contd

35

<400> 6
Thr Lys Xaa Xaa His Arg Ser
1 5

<210> 7
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Binding motif

<220>
<221> MOD_RES
<222> (3)..(4)
<223> "Xaa" represents a variable, modified or unknown
amino acid

<400> 7
Thr Arg Xaa Xaa His Arg Ser
1 5

<210> 8
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:
Oligonucleotide for the construction of a
double-stranded poly histidine segment (Example 1)

<400> 8
gatctcatca ccatcatcac catg

24

<210> 9
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence:
Oligonucleotide for the construction of a
double-stranded poly histidine segment (Example 1)

<400> 9
gatccatggt gatgatggtg atga

24

<210> 10
<211> 54
<212> DNA
<213> Artificial Sequence

<220>

C1
contd

36

<223> Description of Artificial Sequence: Template
oligonucleotide

<220>

<221> modified_base

<222> (1)..(54)

<223> "n" represents a, t, c or g

<400> 10

ggacgcagat ctvnnvnnvn nvnnvnnvnn vnnvnnvnnna gatctagcac cagt

54

<210> 11

<211> 15

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Primer
oligonucleotide

<400> 11

actggtgcta gatct

15

<210> 12

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 12

Arg Ser Val Val Arg Pro Lys Ala Ala Thr Asn Arg Ser

1

5

10

<210> 13

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 13

Arg Ser Arg Ile Arg His Arg Leu Val Gly Gln Arg Ser

1

5

10

<210> 14

<211> 24

<212> PRT

GI
contd

-6
37

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 14

Arg Ser Val Lys Asp Gly Ser Ala Thr Ala Lys Arg Ser Val Ala Asn
1 5 10 15

Phe Glu Thr Pro Arg Val Arg Ser
20

<210> 15

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 15

Arg Ser Ala Pro Gln Thr Gly Arg Pro Asn Asn Arg Ser Leu Pro Leu
1 5 10 15

Gly Asn Arg Asp Met Gln Arg Ser
20

<210> 16

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 16

Arg Ser Val Gln Asn Asp Arg Ile Val Ala Gly Arg Ser
1 5 10

<210> 17

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 17
Arg Ser Tyr Pro Pro Phe His Asn Asn Asp His Arg Ser
1 5 10

```
<210> 18
<211> 24
<212> PRT
<213> Artificial Sequence
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<220>
<223> Description of Artificial Sequence: Sequence conferring the ability of cells to adhere to metal oxides

```
<400> 18
Arg Ser Asn Thr Arg Met Thr Ala Arg Gln His Arg Ser Ala Asn His
  1          5          10          15
Lys Ser Thr Gln Arg Ala Arg Ser
          20
```

```
<210> 19
<211> 24
<212> PRT
<213> Artificial Sequence
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```
<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides
```

```
<400> 19
Arg Ser Leu Ala Ile Asp Gly Thr Asp Val Gln Arg Ser Lys Pro Leu
  1             5             10             15
Ala Arg Ser Ser Gly Ala Arg Ser
          20
```

```
<210> 20
<211> 35
<212> PRT
<213> Artificial Sequence
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```
<220>
<223> Description of Artificial Sequence: Sequence
      conferring the ability of cells to adhere to metal
      oxides
```

<400> 20
Arg Ser Pro Ser Pro Ile Arg Val Pro His His Arg Ser Thr Ala Ile
1 5 10 15
Pro Asn Arg Gln Leu Ile Arg Ser Gln Ile Arg Ile His Ala Met Gly
20 25 30

C1
Contd

His Arg Ser
35

8
39

<210> 21
<211> 35
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 21
Arg Ser Arg Arg Val Arg Asp Ile His Leu Gly Arg Ser Val Gln His
1 5 10 15
Arg Leu Gly Gln Pro Leu Arg Ser Leu His Gln Gln Ser Ser Pro Thr
20 25 30

Leu Arg Ser
35

<210> 22
<211> 46
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 22
Arg Ser Arg Thr Pro Leu Ala Pro Val Pro Val Arg Ser Trp His Ile
1 5 10 15
Gly Ser Arg Thr Ile Ala Arg Ser Phe Asn Gly Ile Thr Ile Gly Asp
20 25 30
Asn Arg Ser Tyr Ile Pro Glu His Trp Tyr Trp Ser Arg Ser
35 40 45

<210> 23
<211> 13
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

409

<400> 23

Arg Ser Gly Arg Met Gln Arg Arg Val Ala His Arg Ser
1 5 10

<210> 24

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 24

Arg Ser Leu Gly Lys Asp Arg Pro His Phe His Arg Ser
1 5 10

<210> 25

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 25

Arg Ser Arg Gly Leu Arg Asn Ile Leu Met Leu Arg Ser Tyr Asp Ser
1 5 10 15

Arg Ser Met Arg Pro His Arg Ser
20

<210> 26

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 26

Arg Ser Glu Pro Arg Arg Ala Thr Gln Ala Pro Arg Ser Lys Pro Gln
1 5 10 15

Lys Asn Glu Pro Ala Pro Arg Ser
20

<210> 27

<211> 35

C1
Control

41
40

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 27

Arg Ser Leu Gly Ala Val Ser Ser Leu Phe Ser Arg Ser Gln Lys Ile
1 5 10 15

Met Gln Thr Asp Ile Val Arg Ser Lys Gly Val Arg Pro Gly Ala Gln
20 25 30

Arg Arg Ser
35

<210> 28

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 28

Arg Ser His His Met Leu Arg Arg Arg Asn Thr Arg Ser
1 5 10

<210> 29

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 29

Arg Ser His Ile Asn Ala Ser Gln Arg Val Ala Arg Ser
1 5 10

<210> 30

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

Cl
contd

42-11

<400> 30

Arg Ser Cys Pro Arg Leu Gly Val Trp Phe Tyr Arg Ser Leu Ser Val
1 5 10 15

Gly Asp Gly Phe Val Arg Arg Ser
20

<210> 31

<211> 35

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 31

Arg Ser Thr Ser Gly Pro Ser Arg Val Met Thr Arg Ser Ile Ile Leu
1 5 10 15

Arg Ile Gly Thr Leu Asp Arg Ser Cys Leu Lys Val Phe His Met Gly
20 25 30

Trp Arg Ser
35

<210> 32

<211> 35

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to metal
oxides

<400> 32

Arg Ser Ile Thr Pro Ile Leu His Asp His Arg Arg Ser Ser Val Arg
1 5 10 15

Pro Met Val Ala His Arg Arg Ser Pro Thr Leu Tyr Phe Pro Ala Ala
20 25 30

Ser Arg Ser
35

<210> 33

<211> 6

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Binding motif

C1
control

4312

<220>
<221> MOD_RES
<222> (3)..(4)
<223> "Xaa" represents a variable, modified or unknown
amino acid

<400> 33
Ser Lys Xaa Xaa Ala Arg
1 5

<210> 34
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Binding motif

<220>
<221> MOD_RES
<222> (3)..(4)
<223> "Xaa" represents a variable, modified or unknown
amino acid

<400> 34
Ser Arg Xaa Xaa Ala Arg
1 5

<210> 35
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Binding motif

<220>
<221> MOD_RES
<222> (3)..(4)
<223> "Xaa" represents a variable, modified or unknown
amino acid

<400> 35
Thr Lys Xaa Xaa Ala Arg
1 5

<210> 36
<211> 6
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Binding motif

C1
contel

44₁₃

<220>
<221> MOD_RES
<222> (3)..(4)
<223> "Xaa" represents a variable, modified or unknown
amino acid

<400> 36
Thr Arg Xaa Xaa Ala Arg
1 5

<210> 37
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Binding motif

<220>
<221> MOD_RES
<222> (2)..(4)
<223> "Xaa" represents a variable, modified or unknown
amino acid

<400> 37
Arg Xaa Xaa Xaa His Arg Ser
1 5

<210> 38
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to ZnO

<400> 38
Arg Ser Asn Thr Arg Met Thr Ala Arg Gln His Arg Ser Ala Asn His
1 5 10 15

Lys Ser Thr Gln Arg Ala Arg Ser
20

<210> 39
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to ZnO

C1
control

454

<400> 39
Arg Ser Val Phe Leu Pro Ser Ile Leu Gly Trp Arg Ser Arg Leu Asp
1 5 10 15

Asp Gln Gly Val Ala Ala Arg Ser
20

<210> 40
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to ZnO

<400> 40
Arg Ser Thr Arg Asn Lys His Thr Thr Ala Arg Arg Ser Val Ala Pro
1 5 10 15

Gly Ile Gly Glu Pro Ser Arg Ser
20

<210> 41
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to ZnO

<400> 41
Arg Ser Ile Met His Val Arg Leu Arg Ala Arg Arg Ser Ala Arg His
1 5 10 15

Met Lys Asp Ala Asp Pro Arg Ser
20

<210> 42
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to ZnO

<400> 42
Arg Ser Pro Ile Ile Ile Arg Ser Arg Ile Asn Arg Ser His Gly Arg
1 5 10 15

Thr Lys Ala Thr Pro Ala Arg Ser
20

4615

C1
Control

<210> 43
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to ZnO

<400> 43
Arg Ser Arg Gly Leu Arg Asn Ile Leu Met Leu Arg Ser Tyr Asp Ser
1 5 10 15

Arg Ser Met Arg Pro His Arg Ser
20

<210> 44
<211> 13
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to ZnO

<400> 44
Arg Ser Thr Arg Arg Gly Thr His Asn Lys Asp Arg Ser
1 5 10

<210> 45
<211> 14
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to ZnO

<400> 45
Arg Ser Thr Val Pro Lys Lys Arg His Pro Lys Asp Arg Ser
1 5 10

<210> 46
<211> 13
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Sequence
conferring the ability of cells to adhere to ZnO

<400> 46
Arg Ser Tyr Asp Ser Arg Ser Met Arg Pro His Arg Ser
1 5 10

<210> 47
 <211> 10
 <212> PRT
 <213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Insert
sequence

<400> 47

Arg Ser His His His His His His Arg Ser
 1 5 10

<210> 48
 <211> 18
 <212> PRT
 <213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Insert
sequence

<400> 48

Arg Ser His His His His His His Arg Ser His His His His His His
 1 5 10 15

Arg Ser

<210> 49
 <211> 24
 <212> PRT
 <213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Insert
sequence

<400> 49

Arg Ser Ala Arg Pro Arg Ser Ala Ser Gly Pro Arg Ser Pro Met His
 1 5 10 15

Thr Ser Thr Thr Pro Pro Arg Ser
 20

<210> 50
 <211> 13
 <212> PRT
 <213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Insert
sequence

481

C1
Contd

<400> 50
Arg Ser Arg Thr His Gly Pro Glu Gly Arg Pro Arg Ser
1 5 10

<210> 51
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Insert
sequence

<400> 51
Arg Ser Ser Leu Ser Leu Phe Phe Arg Asn Arg Arg Ser Ser Val Glu
1 5 10 15

Asp Ala His Gln Thr Met Arg Ser
20

<210> 52
<211> 13
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Insert
sequence

<400> 52
Arg Ser Gly Ala Asn Gly Arg Glu Leu His Thr Arg Ser
1 5 10

<210> 53
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Insert
sequence

<400> 53
Arg Ser Phe Ser Glu Thr Ala Gln Ser Thr Gly Arg Ser Tyr Val Lys
1 5 10 15

Phe Val Trp Arg His His Arg Ser
20

<210> 54
<211> 13
<212> PRT
<213> Artificial Sequence

C1
contd

49¹⁸

<220>

<223> Description of Artificial Sequence: Insert
sequence

<400> 54

Arg Ser Ala Arg Gly His Val Leu Ile Ser Glu Arg Ser
1 5 10

<210> 55

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Insert
sequence

<400> 55

Arg Ser His Leu Ser Arg Leu Arg Gly Asn Arg Arg Ser
1 5 10

<210> 56

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Insert
sequence

<400> 56

Arg Ser Arg Gly Val Asn Asp Ser Pro Asn Gly Arg Ser Ile Thr His
1 5 10 15

Ile Arg Arg Thr His Lys Arg Ser
20

<210> 57

<211> 24

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Insert
sequence

<400> 57

Arg Ser Gln Val Leu Arg Arg Pro Glu Leu Ile Arg Ser Met Pro Glu
1 5 10 15

His Arg Arg Arg Glu His Arg Ser
20

C1
contd

50
~~10~~

<210> 58
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Insert
sequence

<400> 58
Arg Ser Glu Arg Arg Thr Gly Glu Thr Gly Leu Arg Ser His Tyr Gly
1 5 10 15

Gln Leu Gly Tyr Arg Arg Arg Ser
20

<210> 59
<211> 13
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Insert
sequence

<400> 59
Arg Ser Leu Arg Asn Gly Ile Leu Ser Arg His Arg Ser
1 5 10

<210> 60
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Insert
sequence

<400> 60
Arg Ser Thr Val Asn Gly Cys Val Ser His Ser Arg Ser Gly Gly Leu
1 5 10 15

Arg Ala Ser Arg Glu Val Arg Ser
20

<210> 61
<211> 13
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Insert
sequence

C1
contd

51
20

<400> 61

Arg Ser Lys Val Arg Leu Arg Asp Glu His Glu Arg Ser
1 5 10

<210> 62

<211> 13

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Insert
sequence

<400> 62

Arg Ser Glu Gly Arg His Arg Arg Gly Gly Met Arg Ser
1 5 10

<210> 63

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Binding motif

<220>

<221> MOD_RES

<222> (1)..(9)

<223> "Xaa" represents a variable, modified or unknown
amino acid

<400> 63

Thr Xaa Xaa Xaa Xaa His Xaa Lys Asp
1 5